

Improving the continuum theory by crystal plasticity simulations

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Abstract. The continuum plasticity theory has important limitations that are being improved to capture crystal plasticity simulations. In crystal plasticity, transient microstructural responses to strain-path changes can modify the yield surface significantly. The constitutive spin and distortions of the stable part of the yield surface are consequences of texture evolution, leading to an evolution of plastic anisotropy that today is not properly accounted for in continuum models. In continuum plasticity, a model for the spin needs to be prescribed, which plays together with the model for the stress anisotropy. Spin models can cause undesired spurious behavior in combination with kinematic hardening or anisotropic yield functions. In crystal plasticity simulations, the instant yield surface in the elasto-plastic transition has significant impact on the onset of flow instabilities and plastic buckling. An overview and assessment of the differences between crystal and continuum plasticity are given.

Keywords: crystal plasticity, continuum plasticity, modelling, spin, yield surface

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